

Chapter 1-5PRODUCTION CLEANING AND PICKLING OF METALS AND ALLOYS

CONTENTS

Para.

- 1 Introduction
- 2 Production cleaning
- 5 Solvent cleaning
- 7 Trichloroethylene
- 8 Perchloroethylene
- 10 Alkaline cleaning
- 15 Barrel cleaning
- 16 Spray cleaning
- 18 Steam cleaning
- 19 Emulsion cleaning
- 22 Ultrasonic cleaning
- 23 Pickling

Introduction

1 This sub-chapter deals with the cleaning and pickling of metal parts during production machining processes in order to inhibit corrosion; also with metal finishing techniques which avoid embrittlement and impart surface wear-protection in service.

PRODUCTION CLEANING

2 The amount of cleaning necessary is dependent on the subsequent operation. In some cases, it is only necessary for the parts to be reasonably clean and free of heavy scale.

3 Prior to painting, solvent cleaning may suffice, whereas before electroplating a complex cleaning cycle is used to ensure that the surface is sufficiently free of foreign bodies to obtain an adherent deposit.

4 For cleaning and/or degreasing, one of the following methods may be employed.

Solvent cleaning

5 This method leaves the surface dry. The solvent may be used in a degreaser unit equipped with condensing coils to retain the vapour within the unit.

WARNING ...

COLD SOLVENTS MAY BE HIGHLY FLAMMABLE, OR GIVE OFF TOXIC FUMES OR BOTH. WHERE SUCH UNITS ARE EMPLOYED THEY ARE SUBJECT TO RIGOROUS SAFETY PRECAUTIONS AND REGULATIONS.

6 One of the following cold solvents may be used.

Trichloroethylene

7 For normal degreasing the articles may be immersed in trichloroethylene solvent vapour. When it is necessary to remove grease and inert oils, a multi-stage unit may be used, the articles being first briefly dipped in liquid solvent and then exposed to the vapour.

Perchloroethylene

8 Perchloroethylene is used in place of Trichloroethylene for the removal of some waxes with high melting points, and in the presence of aluminium dust.

9 Petroleum liquids, e.g. petrol, paraffin, white spirits, and cleansing fluids may also be used.

Alkaline cleaning

10 Hot alkaline cleaning is the most widely used method. The cleaners are based on an alkali, sodium carbonate or hydroxide, with silicates, phosphates or borates with added soaps and wetting agents.

11 Dependent on the process requirement, the normal concentration is 25 to 100 g/litre.

Notes ...

- (1) For steel parts, strong alkaline solutions may be used.
- (2) To avoid surface etching, mild alkaline solutions are to be used on aluminium and zinc metals.

12 Prior to electro-plating it is normal to immerse the articles in hot cleaner solution in two stages, the second stage generally being an electrolytic cleaner at a lower temperature. Typical temperatures/durations being of the order of 70 to 90° for 1/2m to 5m.

13 Anodic cleaning is usual on steel parts to avoid hydrogen embrittlement; cathodic cleaning being preferred on other metals.

14 There are five methods of alkaline cleaning, detailed in para. 15 to 22.

Barrel cleaning

15 Generally used for small articles in bulk, where the articles are rotated in a barrel immersed in alkaline solution.

Spray cleaning

16 The work pieces are carried on a conveyor line through a series of sprays which project a hot alkaline or emulsion cleaner.

17 The cleaners are generally non-foaming and at a fairly low concentration. The workpieces are spray-rinsed and dried on completion.

Steam cleaning

18 Usually employed on large components and structures, using a steam pressure of 4 to 10 bar with a concentration of approx. 1g detergent/litre. Normal application duration is from 2 to 10 seconds.

Emulsion cleaning

19 For the removal of heavy oil, grease layers, polishing compound residues etc.

20 The cleaners may be of emulsifiable solvents, emulsifiers, co-solvents, detergents and a small amount of water. The water-based solvents may be used cold or at a temperature of 50 to 65°C.

21 After immersion the work is washed with a high pressure spray. Alternatively, the surface of the article may be cleaned and then washed in water.

Ultrasonic cleaning

22 A process effective for small crevices, blind holes, fine screw threads etc., in which high-frequency vibrations are transferred to the solvent or alkali solution to produce a vigorous and penetrating turbulent action on the immersed parts. (For details of ultrasonic cleaning principles and equipment, refer to AP 119G-0133-135F).

PICKLING

23 Pickling is the chemical removal of scale and oxide film from metals by circulating a suitable acid, containing inhibitors, to prevent corrosion of the basis metal.

24 The most commonly employed agent is sulphuric acid (at up to ten times dilution) used hot (60 to 70°C) for the descaling of steel, copper and its alloys.

25 Proprietary alkaline de-rusting solutions are being increasingly used.

26 Dilute hydrochloric acid, 15 to 50% by volume, is often used for smaller scale pickling processes prior to electro-plating, and for the pickling of steel strip.

27 Such solutions may be used cold and generally give a cleaner finish than sulphuric acid.

28 Whichever agent is used for pickling, the parts must be thoroughly rinsed and neutralised immediately following treatment to avoid rusting and staining.

29 Should phosphoric acid solutions be employed, the residual acid on the workpiece surface will resist corrosion and provide a key for later painting operations. Rinsing following treatment, is not therefore required.

30 Corrosion-resisting steels may be pickled in a solution of nitric and hydrofluoric acids.

31 Brass may be bright dipped using either a solution of nitric/sulphuric acids or chromic/sulphuric acids.